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Nonwoven web with improved adhesion and reduced dust formation

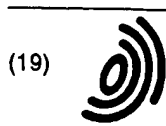
### Abstract:

Making suitable nonwoven webs requires good adhesion between the binder and the absorbent material. The present invention relates to a nonwoven web having improved adhesion based on tackifiers present in the binder. Optionally, the binder with tackifier may also contain an adhesion promoter, usually grafted polyolefins, and an enhancement agent, usually inactive inorganic compounds in powder form. The web comprises from about 5 to about 25% by weight binder fiber and from a

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bout 75 to 95% by weight absorbent. The absorbent may be a natural absorbent or a super absorbent polymer or a combination of these. The binder fiber contains less than about 40% by weight tackifier. Tackifier is selected from the class of rosin, rosin esters, terpene based, piperylene based, and hydrocarbon based compounds.

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(54) **Nonwoven web with improved adhesion and reduced dust formation**

(57) Making suitable nonwoven webs requires good adhesion between the binder and the absorbent material. The present invention relates to a nonwoven web having improved adhesion based on tackifiers present in the binder. Optionally, the binder with tackifier may also contain an adhesion promoter, usually grafted polyolefins, and an enhancement agent, usually inactive inorganic compounds in powder form. The web comprises from about 5 to about 25% by weight binder fiber and

from about 75 to 95% by weight absorbent. The absorbent may be a natural absorbent or a super absorbent polymer or a combination of these. The binder fiber contains less than about 40% by weight tackifier. Tackifier is selected from the class of rosin, rosin esters, terpene based, piperylene based, and hydrocarbon based compounds.

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## Description

BACKGROUND OF THE INVENTION

## 5 1. Field of the Invention

[0001] The present invention relates to dry laid and wet laid nonwoven webs useful in diapers, incontinent pads, sanitary napkins, and other absorbent pads for liquids. In particular, these pads usually comprise binder and wood pulp or other absorbent material. Making suitable nonwoven webs for these uses requires good adhesion between the binder and the absorbent material. More specifically, the present invention relates to a nonwoven web having improved adhesion based on tackifiers present in the binder. Tackifiers include rosin, rosin esters, and terpene based, piperylene based, and hydrocarbon based compounds. Optionally, the binder with tackifier may also contain an adhesion promoter, usually grafted polyolefins, and an enhancement agent, usually inactive inorganic compounds in powder form.

## 15 2. Prior Art

[0002] Nonwoven webs particularly in the form of disposal absorbent articles such as disposable diapers, have had much success in the marketplace. However, there is always a need to improve these products and particularly in terms of their adhesion such that they do not fall apart during manufacturing, processing into articles, and during use. Prior to the present invention, it was known to form existing nonwovens from absorbent (wood pulp and optionally up to 25% by weight super absorbent polymer, SAP), and a binder such as a bicomponent fiber or a low melt polymer fiber. These existing compositions contained approximately 10% binder and approximately 80 to 90% by weight absorbent.

[0003] These nonwoven webs were first created by mixing the wood pulp (and optionally SAP) with the binder. This composition was then introduced into a heating zone, such that the lower melt material of the polymer, or the lower melting material of the bicomponent fiber would melt and coat at least a portion of most of the wood pulp fibers (and any optional SAP). The composition was then introduced into a cooling zone where the lower melting binder material would solidify thereby binding the wood pulp (and optional SAP) into a unitary web structure.

[0004] Optionally, other fibers may be introduced such as other synthetic fibers or natural fibers to achieve other desired characteristics such as low density, high loft, compression resistance, and fluid uptake rate.

[0005] U.S. Patent 5,981,410 to Hansen, et al. discloses bicomponent fibers blended with cellulose fibers such as pulp fibers or cotton fibers to create a nonwoven web useful in disposable diapers, for example.

[0006] U.S. Patent 5,994,244 to Fujiwara, et al. discloses a nonwoven web comprised of cellulose type fibers such as fluff pulp and low melt fibers useful in producing disposable diapers, among other things. It also discloses the addition of inorganic particle (e.g.  $\text{TiO}_2$ ) to the ethylene-acrylic ester-maleic anhydride sheath bicomponent spunbond filament. The particles reduce the adhesion of the filaments during spinning and give a more uniform web.

[0007] Suitable bicomponent fibers can be found in U.S. Patent 4,950,541 to Tabor, et al. and U.S. Patent 5,372,885 to Tabor, et al., both of which are hereby incorporated by reference. These patents disclose the use of a low melt maleic acid or maleic anhydride grafted polyethylene.

[0008] U.S. Patent 5,126,201 to Shiba et al. discloses the addition of  $\text{TiO}_2$  in both the core and sheath of bicomponent binder fibers to improve the cutting efficiency of nonwoven webs. The amount of  $\text{TiO}_2$  in the core is  $>1.5\%$ , preferably there is no  $\text{TiO}_2$  in the sheath, since  $\text{TiO}_2$  in the sheath reduces adhesion.

[0009] Japanese Patent JP 02-169718 to Matsuo et al. discloses polyolefin sheath/polyester core bicomponent fibers, the sheath containing 0.3-10% of inorganic particles (preferably  $\text{TiO}_2$ ) to obtain a better softness and opacity of the web. This patent teaches that the addition of inorganic particles reduce the nonwoven strength.

SUMMARY OF THE INVENTION

[0010] As stated previously, there is still a need in the art to improve the adhesion of these nonwoven webs. The present invention is an improvement over these existing nonwoven web products. In particular, the present invention improves the adhesion by employing a tackifier. Tackifiers include rosin, rosin esters, and terpene based, piperylene based, and hydrocarbon based compounds.

[0011] The present invention relates to either bicomponent fiber or low melt polymer fiber, and tackifier thereby producing a binder with improved adhesion. The bicomponent fiber contains a high melting portion and a low melting portion, with the low melting portion containing tackifier. If low melt fiber (instead of bicomponent fiber) was employed it likewise contains tackifier. The tackifier is believed to act as an adhesion promoting agent better binding the absorbent material together into a unitary web. The low melt polymer fiber or the low melting portion of the bicomponent fiber is defined as "low melt base".

[0012] In the broadest sense, the present invention comprises a binder fiber containing tackifier. The binding fiber

may be a bicomponent fiber or a typical low melt polymer fiber. The low melt base contains the tackifier. The binder fiber containing tackifier may optionally contain an adhesion promoter and an enhancement agent.

[0013] In the broadest sense, the web of the present invention comprises binder fiber containing tackifier and an absorbent. The absorbent may be synthetic or natural.

5 [0014] In the broadest sense, the present invention also comprises a web comprising from about 5 to about 25% by weight binder fiber and from about 75 to 95% by weight absorbent. The absorbent may be a natural absorbent or a super absorbent polymer or a combination of these. The binder fiber contains less than about 40% by weight tackifier based on the low melt base.

## 10 DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] Suitable absorbents are natural or synthetic absorbents. Synthetic absorbents are primarily known as super absorbent polymers (SAP). The absorbents comprise 75 - 95 % by weight of the web. Natural absorbents are hydrophilic materials such as cellulosic fibers, wood pulp fluff, cotton, cotton linters, and regenerated cellulose fibers such as rayon, or a mixture of these. Preferred is wood pulp fluff, which is both inexpensive and readily available.

15 [0016] Absorbent pads employing natural absorbents may not provide adequate fluid intake for all circumstances. Also natural absorbents are very bulky. Accordingly, many absorbent pads employ SAP in relatively low quantities. This is because the cost of SAP is much higher than the cost of natural absorbents. Replacing some of the natural absorbents with SAP can reduce the overall bulk of the pad and/or provide superior fluid intake.

20 [0017] As used herein, the term "super absorbent polymer" or "SAP" refers to a water-swellaable, generally water-insoluble material capable of absorbing at least about 10, desirably about 20, and preferably about 50 times or more its weight in water. The super absorbent polymer may be formed from organic material, which may include natural materials such as agar, pectin, and guar gum, as well as synthetic materials such as synthetic hydrogel polymers. Synthetic hydrogel polymers include, for example, carboxymethyl cellulose, alkali metal salts of polyacrylic acid, polyacrylamides, polyvinyl alcohol, ethylene maleic anhydride copolymers, polyvinyl ethers, hydroxypropyl cellulose, polyvinyl morpholinone, polymers and copolymers of vinyl sulfonic acid, polyacrylates, polyacrylamides, polyvinyl pyridine, and the like. Other suitable polymers include hydrolyzed acrylonitrile grafted starch, acrylic acid grafted starch, and isobutylene maleic anhydride copolymers and mixtures thereof. The hydrogel polymers are preferably lightly crosslinked to render the materials substantially water insoluble. Crosslinking may, for example, be by irradiation or covalent, ionic, van der Waals, or hydrogen bonding. Suitable materials are available from various commercial vendors such as the Dow Chemical Company, Allied Colloid, Inc., and Stockhausen, Inc. The super absorbent polymer may be in the form of particles, flakes, fibers, rods, films or any of a number of geometric forms.

30 [0018] The binder fibers of the present invention can either be in the form of a low melt fiber, or a bicomponent fiber. The low melting portion of the bicomponent fiber would comprise the same material as the low melt fiber. The preferred binder fiber of the present invention is the bicomponent. Binder fibers have an average length of from about 3 to about 75 mm. Binder fibers having a denier of between 1 and 10 are preferred. The low melt base can be polyolefin, such as polyethylene (PE), polypropylene (PP), polybutylene or a mixture of these. Suitable polyethylene may be high density polyethylene (HDPE), medium density polyethylene (MDPE), low density polyethylene (LDPE), linear low density polyethylene (LLDPE), ultra low density polyethylene (ULDPE); or a mixture of these. These polyolefins may be produced with either Ziegler-Natta or metallocene catalysts. Alternatively, the low melt base can be a low melting polyester such as polybutylene terephthalate (PBT), or polytrimethylene terephthalate (PTT), a low melting copolyester such as copolymers of PET with comonomers such as suitable diol components selected from 1,4-cyclohexanedimethanol, 1,2-propanediol, 1,3-propanediol, 1,4-butanediol, 2,2-dimethyl-1,3-propanediol, 1,6-hexanediol, 1,2-cyclohexanediol, 1,4-cyclohexanediol, 1,2-cyclohexanedimethanol, 1,3-cyclohexanedimethanol, and diols containing one or more oxygen atoms in the chain, e.g., diethylene glycol, triethylene glycol, dipropylene glycol, tripropylene glycol, or mixtures of these; or one or more diacid components other than terephthalic acid, (aliphatic, alicyclic, or aromatic dicarboxylic acids) such as isophthalic acid, 1,4-cyclohexanedicarboxylic acid, 1,3-cyclohexanedicarboxylic acid, succinic acid, glutaric acid, adipic acid, sebacic acid, 1,12-dodecanedioic acid, 2,6-naphthalenedicarboxylic acid, bibenzoic acid, or mixtures of these.

45 [0019] Bicomponent fibers can be of the type in which the low melting portion is adjacent to the high melting portion such as a side-by-side configuration, or a sheath-core configuration where the sheath is the low melting component and the core is the high melting component. The high melting portion may be selected from the class of polyolefins, such as polyethylene, polypropylene, and polybutylene; polyesters such as polyethylene terephthalate (PET), polybutylene terephthalate, polyethylene naphthalate, and the like; polyamides such as nylon 6, nylon 66; polyacrylates such as polymethacrylate, polymethylmethacrylate, and the like; as well as mixtures and copolymers of these. The low melting portion, in a suitable bicomponent fiber melts at a temperature of at least about 5°C lower than said high melting portion.

50 [0020] Suitable bicomponent fibers have a low melting portion that comprises from about 5 to about 75% by weight

of the bicomponent fiber, with the remainder being the high melting portion. If, for example, a 50-50 bicomponent fiber is employed as the binder fiber, the 50% by weight low melting portion is low melt base polyolefin with less than about 40% by weight tackifier (with or without an adhesion promoter or enhancement agent, or a mixture thereof), and the 50% by weight high melting portion could be PET.

**[0021]** Ignoring other components for a moment, suitable bicomponent fibers are polyethylene/polypropylene; polyethylene/polyester (especially polyethylene terephthalate); polyethylene/nylon, copolyester/PET; PBT/PET; PTT/PET for example, as well as mixtures of these. Preferably polyethylene/polyester fibers, such as LLDPE/PET or polyethylene/polypropylene, such as LLDPE/PP are used. When both the low melting portion and the high melting portion of the bicomponent fiber contains polyolefins, the high melting polyolefin must have a melting point at least about 5 ° C higher than the low melting polyolefin.

**[0022]** Tackifiers include rosin, rosin esters, and terpene based, piperylene based, and hydrocarbon based compounds. Commercially available rosin based tackifiers are known as Foral 85 made by Hercules, Inc.; Permalyne 2085 made by Eastman Chemicals; or Escorez 5400 made by Mobil Exxon Chemical. Commercially available terpene based tackifiers are Zonarez, Zonatac and Nirez from Arizona Chemical Company. Commercially available piperylene based tackifiers are Picotac and Hercotac available from Hercules, Inc. A commercially available hydrocarbon based tackifier is Escorez 5400 from ExxonMobil. The preferred tackifier is rosin ester, and most preferred is a glycerin ester of tall oil rosin. The tackifier preferably comprises from about 0.1 to about 40% by weight of the low melt base, and preferably 0.5 to 10%, and most preferably 1 to 5 %.

**[0023]** The adhesion promoters, such as polyolefins grafted with maleic acid or maleic anhydride (MAH), both of which convert to succinic acid or succinic anhydride upon grafting to the polyolefin, can be optionally used in addition to the tackifier. The preferred incorporated MAH graft level is 10% by weight (by titration). Also, ethylene-acrylic copolymers, and a combination of this with the grafted polyolefins mentioned are suitable adhesion promoters. Commercially available maleic anhydride grafted polyethylene are known as ASPUN resins from Dow Chemical. Commercially available ethylene-acrylic copolymers are Bynel 2022, Bynol 21E533 and Fusabond MC 190D from DuPont, and the Escor acid terpolymers from ExxonMobil. The ethylene-acrylic copolymer comprises from about 1 to about 20% by weight based on the weight of the low melt base, and preferably from 5 to 15% by weight. The amount of grafted polyolefin adhesion promoter is such that the weight of incorporated maleic acid or maleic anhydride comprises from about 0.05% to about 2% by weight, and preferably from 0.1 to 1.5% based on the weight of the low melt base.

**[0024]** Enhancement agents can be optionally used in addition to the tackifier and the optional adhesion promoter. The enhancement agent can comprise any of titanium dioxide, talc, silica, alum, calcium carbonate, calcium oxide, magnesium and other oxides; titanium dioxide being preferred. The enhancement agent is employed in the polymer in an amount from about 0.1 to about 1% based on the weight of the low melt base. The particle size, in order to achieve good dispersion within the polymer and good spinnability is in the range of about 0.04 to about 5 microns, and preferably in the range of 0.05 to 2 micron.

**[0025]** Once the low melt base with tackifier and any adhesion promoter and any enhancement agent is produced, preferably by blending master batches to the low melt base, it is melt spun into fiber as is known in the art.

**[0026]** Webs of the present invention can be made by either dry laid or wet laid processes. Dry laid webs are made by the airlay, carding, garneting, or random carding processes. Airlaid webs are created by introducing the fibers into an air current, which uniformly mixes the fibers and then deposits them on a screen surface. The carding process separates tufts into individual fibers by combing or raking the fibers into a parallel alignment. Garneting is similar to carding in that the fibers are combed. Thereafter the combed fibers are interlocked to form a web. Multiple webs can be overlapped to build up a desired weight. Random carding uses centrifugal force to throw fibers into aweb with random orientation of the fibers. Again multilayers can be created to obtain the desired web weight. The dry laid components are then bonded together. Wet laid webs are made by a modified papermaking process in which the fibers are suspended in water, decanted on a screen, dried and bonded together.

**[0027]** The webs are bonded by a binding fiber such as low melt polymer fiber or bicomponent fiber as noted above. The web of fibers (binder fibers and absorbent) can be bonded together by thermal means. Thermal bonding melts the binder fibers in an oven (hot air, radiant or microwave), or heated calendar roll(s), or by ultrasonic energy. Next, the web is cooled thereby solidifying the melted binder fiber. The web now has sufficient rigid structure to be useful as a component of an absorbent pad.

**[0028]** The webs are made by merely mixing the binder fiber (either the low melt polymer fiber or bicomponent fiber, or both) with the absorbent fibers (with or without SAP) using dry laid or wet laid techniques. The absorbent is mixed with the binder fiber such that the binder fiber comprises from about 5 to about 25 percent by weight of the total web, with the remainder being substantially the absorbent. The web compositions of the present invention can be layered until their weight is in the range from about 20 to about 500 grams per square meter (gsm), preferably from about 50 to about 250 gsm. Thereafter, the web may be cut into various lengths and widths for end use applications, namely, fenestration drapes, dental bibs, eye pads, diapers, incontinent pads, sanitary napkins, wound dressing pads, air filters, liquid filters and fabrics such as drapes, bedding or pillows.

TEST PROCEDURE

[0029] The dry strength of the web was measured according to TAPPI test method T 498 om-88. The web strength was tested on a 25.4x 203.2 millimeter strip for both the MD (machine direction) and CD (cross direction) with an Instron 1122 test machine. The tests were run at 127 mm original separation at a speed of 304.8 mm per minute. The strength is reported in units of g/25 mm.

[0030] Bonding Index is the square root of the product of the machine direction and cross direction strengths.

[0031] The dust test used a 127 x 127 mm section of the web, cut into 25.4 x 25.4 mm samples. The samples were put into a Fluff Fiberization machine. An air stream with 100 PSI was applied to the samples for 300 seconds. The loosed fiber (dust) was collected with a filter. The percent of weight lost was reported as the percent of dust.

EXAMPLES

[0032] In the following examples various bicomponent fibers were made with a core of 0.55 IV,PET and a sheath of various compositions. The bicomponent fibers comprised a 50/50 core/sheath with the sheath being mainly LLDPE. The LLDPE was obtained from Dow Chemical Company as Aspun XU 61800.34 (Dow 34), which contains 10% by weight incorporated MAH. Additives (tackifier, adhesion promoter and enhancement agent) in a preblend were mixed with the sheath polymer prior to fiber spinning. The tackifier was preblended with 40% concentrate of the sheath polymer. The bicomponent fibers, after being spun and drawn, were cut into 6mm lengths.

[0033] The webs comprised 12% bicomponent fiber by weight and 88% wood pulp. The pulp type employed was Waco 416. The percentage of tackifier, adhesion promoter, and enhancement agent used in the Examples (and set forth in the Tables) are based on the weight of the low melt base.

Example 1

[0034] Various bicomponent fibers were as shown in Table 1. The adhesion promoters were maleic anhydride grafted polyethylene obtained from Dow Chemical as ASPUN XU 60769.07 (Dow07), ethylene-acrylic copolymers obtained from DuPont as BYNEL 2022 and from ExxonMobil as ESCOR AT-325. The tackifier was a glycerin ester of tall oil rosin obtained from Eastman Chemical as PERMLYN 2085.

[0035] Nonwoven webs were made from these bicomponent fibers with a wet-lay process to give a basis weight of 51 g/m<sup>2</sup>. The web samples were dried at 100° C for 32 seconds and then bonded in a hot air oven at 135° C for 15 seconds. The bonding indices are shown in Table 1, and compared to the control which did not contain a tackifier.

Table 1

Fiber	Adhesion Promoter, %	Tackifier, %	Bonding Temp., C	Bonding Index, g/25 mm	Relative to Control, %
Control	Dow 07, 10%	None	135	250.9	
1	Bynel 2022, 5%	Permalyn, 5%	135	368.9	47.0
2	Escor AT 325, 5%	Permalyn, 5%	135	285.4	13.8
3	Dow 07, 5%	Permalyn, 5%	135	388.1	54.7
4	Escor AT 325, 8%	Permalyn, 2%	135	281.1	12.0

[0036] This example shows the improved tensile strength using a tackifier and adhesion promoter.

Example 2

[0037] In this example wet laid webs were prepared in the same manner as in Example 1, and examined the effect on adhesion promoter and tackifier levels on web strength. The bicomponent compositions and bonding indices are reported in Table 2. The control was a sheath that contained no adhesion promoter or tackifier.

Table 2

Fiber	Adhesion Promoter, %	Tackifier, %	Bonding Temp., C	Bonding Index, g/25 mm	Relative to Control, %
Control	None	None	135	314.3	
5	Dow 07, 5%	None	135	267.0	-15.0

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Table 2 (continued)

Fiber	Adhesion Promoter, %	Tackifier, %	Bonding Temp., C	Bonding Index, g/ 25 mm	Relative to Control, %
6	Dow 07, 10%	None	135	339.7	8.1
7	None	Permalyne, 5%	135	415.7	32.3
8	Dow 07, 5%	Permalyne, 5%	135	442.2	40.7
9	Dow 07, 10%	Permalyne, 5%	135	412.5	31.2
10	None	Permalyne, 10%	135	422.3	34.4
Control	None	None	317853		
5	Dow 07, 5%	None	175	345.7	-8.6
6	Dow 07, 10%	None	175	401.6	6.2
7	None	Permalyne, 5%	175	405.7	7.2
8	Dow 07, 5%	Permalyne, 5%	175	493.4	30.4
9	Dow 07, 10%	Permalyne, 5%	175	492.9	30.3
10	None	Permalyne, 10%	175	444.3	17.4

[0038] This example shows that a tackifier alone, without an adhesion promoter, improves the bonding index of the web.

## Example 3

[0039] This example studies the effect of tackifier level using webs prepared as in Example 1. The bicomponent compositions and bonding indices are reported in Table 3. The control was a sheath that contained 5 % Dow 07 adhesion promoter.

Table 3

Fiber	Adhesion Promoter, %	Tackifier, %	Bonding Temp., C	Bonding Index, g/ 25 mm	Relative to Control, %
Control	Dow 07, 5%	None	135	210.1	
11	Dow 07, 5%	Permalyne 2085, 1%	135	337.7	60.8
12	Dow 07, 5%	Permalyne 2085, 2.5%	135	346.3	64.8
13	Dow 07, 5%	Permalyne 2085, 3.75%	135	352.6	67.8
14	Dow 07, 5%	Permalyne 2085, 5%	135	401.6	91.2
Control	Dow 07, 5%	None	175	268.2	
11	Dow 07, 5%	Permalyne 2085, 1%	175	431.0	60.7
12	Dow 07, 5%	Permalyne 2085, 2.5%	175	351.4	31.0
13	Dow 07, 5%	Permalyne 2085, 3.75%	175	456.1	70.1
14	Dow 07, 5%	Permalyne 2085, 5%	175	452.7	68.8

[0040] This example shows that even a low level of tackifier, 1 % by weight, improves the bonding index dramatically.

## Example 4

[0041] Bicomponent fibers were prepared as in Example 1. These fibers were air laid with the wood pulp to give webs with a basis weight of 175 g/m<sup>2</sup>. The web passed through a dryer with 15 seconds residence time at 140 or 175° C. The bicomponent compositions and bonding indices are reported in Table 4. The control was a sheath that contained

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10 % Dow 07 adhesion promoter. In this example an enhancement agent, TiO<sub>2</sub>, was used. The TiO<sub>2</sub> was preblended with the sheath polyethylene (Dow 34) at a 35% concentration.

Table 4

Fiber	Adhesion Promoter, %	Tackifier, %	TiO <sub>2</sub> , %	Bonding Temp., C	Bonding Index, g/25 mm	Relative to Control, %
Control	Dow 07, 10%	None	None	140	267.0	
15	Dow 07, 5%	Permalyne 2085, 2.5%	None	140	342.4	28.2
16	Dow 07, 5%	Permalyne 2085, 2.5%	0.70	140	414.9	55.4
17	Dow 07, 5%	Permalyne 2085, 2.5%	0.35	140	398.9	49.4
18	Dow 07, 5%	Permalyne 2085, 5%	0.35	140	413.8	55.0
19	Dow 07, 5%	Permalyne 2085, 5%	0.70	140	348.0	30.3

[0042] The enhancement agent improved the bonding index.

[0043] Dust formation in air-laid processes is of concern. The webs from the control and runs 16 and 19, bonded at 140° C were subjected to the dust test. The results are shown in Table 5.

Table 5

Fiber	Adhesion Promoter, %	Tackifier, %	TiO <sub>2</sub> , %	Bonding Temp., C	Dust, %	Dust reduction
Control	Dow 07, 10%	None	None	140	7.95	
16	Dow 07, 5%	Permalyne 2085, 2.5%	0.7	140	6.45	18.9
19	Dow 07, 5%	Permalyne 2085, 5%	0.7	140	6.96	12.5

[0044] The tackifier with enhancement agent reduced the dust formation.

[0045] Thus it is apparent that there has been provided, in accordance with the invention, a binder fiber with tackifier, and a web made therefrom, that fully satisfies the objects, aims, and advantages set forth above. While the invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications, and variations as fall within the spirit and broad scope of the appended claims.

## Claims

1. An improved adhesion binder comprising the combination of a binder fiber containing low melt base and tackifier, said low melt base is low melt polymer fiber, the low melting portion of bicomponent fiber, or both.
2. The improved binder of claim 1, wherein said tackifier is selected from the class of rosin, rosin esters, terpene based, piperylene based, and hydrocarbon based compounds.
3. The improved binder of claim 1, wherein said bicomponent fiber has a high melting portion.
4. The improved binder of claim 3, wherein said high melting portion is selected from the class of polyamide, polyester, polyolefin, polyacrylate, and mixtures thereof.
5. The improved binder of claim 4, wherein said high melting portion is polyester.
6. The improved binder of claim 4, wherein said high melting portion is polyolefin.



7. The improved binder of claim 1, wherein said tackifier comprises from about 0.1 to about 40% by weight of said low melt base.
8. The binder of claim 3, wherein said low melting portion comprises from about 5% to about 75 % by weight of said bicomponent fiber.
9. The improved binder of claim 1, wherein said low melt base is selected from the class of polyethylene, polypropylene, polybutylene, polyesters, copolyesters, or a mixture thereof.
10. The improved binder of claim 9, wherein said polyethylene is selected from the class of HDPE, MDPE, LDPE, LLDPE, ULDPE, or mixtures of these.
11. The improved binder of claim 9, wherein said polyesters and said copolyesters are selected from the class of polybutylene terephthalate (PBT), polytrimethylene terephthalate (PTT), a low melting copolyester such as copolymers of PET with comonomers such as suitable diol components selected from 1, 4-cyclohexanedimethanol, 1,2-propanediol, 1,3-propanediol, 1,4-butanediol, 2,2-dimethyl-1,3-propanediol, 1,6-hexanediol, 1,2-cyclohexanediol, 1,4-cyclohexanediol, 1,2-cyclohexanedimethanol, 1,3-cyclohexanedimethanol, and diols containing one or more oxygen atoms in the chain, such as diethylene glycol, triethylene glycol, dipropylene glycol, tripropylene glycol, or mixtures of these; or one or more diacid components other than terephthalic acid, (aliphatic, alicyclic, or aromatic dicarboxylic acids) such as isophthalic acid, 1,4-cyclohexanedicarboxylic acid, 1,3-cyclohexanedicarboxylic acid, succinic acid, glutaric acid, adipic acid, sebacic acid, 1,12-dodecanedioic acid, 2,6-naphthalenedicarboxylic acid, bibenzoic acid, or mixtures of these.
12. The improved binder of claim 1, wherein said low melt polymer fiber is substantially said low melt base and said tackifier.
13. The improved binder of claim 1, additionally comprising an adhesion promoter in said low melt base.
14. The improved binder of claim 13, wherein said adhesion promoter is selected from the class of maleic acid or maleic anhydride grafted polyolefin, ethylene-acrylic copolymers, or a combination of these.
15. The improved binder of claim 14, wherein said grafted polyolefin contains incorporated maleic acid or maleic anhydride in the range from about 0.05 to about 2.0 weight % of said low melt base.
16. The improved binder of claim 14, wherein said ethylene-acrylic copolymers are present in a range of about 1 to about 20 weight % of said low melt base.
17. The improved binder of claim 1, additionally comprising an enhancement agent in said low melt base.
18. The improved binder of claim 17, wherein said enhancement agent is selected from the class of titanium dioxide, talc, silica, alum, calcium carbonate, calcium oxide, and magnesium oxide.
19. The improved binder of claim 17, wherein said enhancement agent is present in a range of about 0.1 to 1.0 weight % of said low melt base.
20. A nonwoven web comprising binder fiber and absorbent, said binder fiber containing tackifier and low melt base, said low melt base is a low melt polymer fiber, a low melting component of bicomponent fiber, or both.
21. The web of claim 20, wherein said binder fiber is from about 5 to about 25 weight % of said web.
22. The web of claim 20, wherein said absorbent comprises natural absorbents, super absorbent polymer, or both.
23. The web of claim 20, wherein said bicomponent fiber has a high melting portion.
24. The web of claim 23, wherein said high melting portion is selected from the class of polyamides, polyesters, polyolefins, polyacrylates, and mixtures thereof.
25. The web of claim 24, wherein said high melting portion is polyester.

26. The web of claim 24, wherein said high melting portion is polyolefin.
27. The web of claim 20, wherein said tackifier comprises from about 0.1 to about 40 % by weight of said low melt base.
- 5 28. The web of claim 20, wherein said tackifier is selected from the class of rosin, rosin esters, terpene based, piperylene based, and hydrocarbon based compounds.
29. The web of claim 20, wherein said low melt polymer fiber is substantially low melt base and said tackifier.
- 10 30. The web of claim 20, wherein said low melt base is selected from the class of polyethylene, polypropylene, polyesters, or copolyesters, or a mixture thereof.
31. The web of claim 30, wherein said polyethylene is selected from the class of HDPE, MDPE, LDPE, LLDPE, ULDPE, or mixtures of these.
- 15 32. The web of claim 30, wherein said polyesters and said copolyesters are selected from the class of as polybutylene terephthalate (PBT), polytrimethylene terephthalate (PTT), a low melting copolyester such as copolymers of PET with comonomers such as suitable diol components selected from 1, 4-cyclohexanedimethanol, 1,2-propanediol, 1,3-propanediol, 1,4-butanediol, 2,2-dimethyl-1, 3-propanediol, 1,6-hexanediol, 1,2-cyclohexanediol, 1,4-cyclohexanediol, 1,2-cyclohexanedimethanol, 1,3-cyclohexanedimethanol, and diols containing one or more oxygen atoms in the chain, such as diethylene glycol, triethylene glycol, dipropylene glycol, tripropylene glycol, or mixtures of these; or one or more diacid components other than terephthalic acid, (aliphatic, alicyclic, or aromatic dicarboxylic acids) such as isophthalic acid, 1,4-cyclohexanedicarboxylic acid, 1,3-cyclohexanedicarboxylic acid, succinic acid, glutaric acid, adipic acid, sebacic acid, 1,12-dodecanedioic acid, 2,6-naphthalenedicarboxylic acid, bibenzoic acid, or mixtures of these.
- 20 33. The web of claim 20, additionally comprising an adhesion promoter in said low melt base.
34. The web of claim 44, wherein said adhesion promoter is selected from the class of maleic acid or maleic anhydride grafted polyolefin, ethylene-acrylic copolymers, or a combination of these.
- 30 35. The web of claim 34, wherein said grafted polyolefin contains incorporated maleic acid or maleic anhydride in the range from about 0.05 to about 2.0 weight % of said low melt base.
- 35 36. The web of claim 34, wherein said ethylene-acrylic copolymers are present in a range of about 1 to about 20 weight % of said low melt base.
37. The web of claim 33, wherein said bicomponent fiber has a high melting portion.
- 40 38. The web of claim 37, wherein said high melting portion is selected from the class of polyamides, polyesters, polyolefins, polyacrylates, and mixtures thereof.
39. The web of claim 38, wherein said high melting portion is polyester.
- 45 40. The web of claim 38, wherein said high melting portion is polyolefin.
41. The web of claim 20, wherein said low melt base also contains enhancement agent.
42. The web of claim 41, wherein said enhancement agent is selected from the class of titanium dioxide, talc, silica, alum, calcium carbonate, calcium oxide, and magnesium oxide.
- 50 43. The web of claim 41, wherein said enhancement agent is present in a range from about 0.1 to 1.0 weight % of said low melt base.



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## EUROPEAN SEARCH REPORT

Application Number  
EP 03 00 8859

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